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Implementing Procedures For Minicomputers

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ENVIRONMENTAL PROTECTION AGENCY
Management Information and Data Systems Division
PM-218
Washington, D.C. 20460

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IMPLEMENTING PROCEDURES

FOR MINICOMPUTERS

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ENVIRONMENTAL PROTECTION AGENCY
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INTRODUCTION

This document describes the major activities involved in acquiring a minicomputer, once the feasibility study has been approved. These guidelines include ordering the equipment, planning and controlling the implementation, developing the executing a training program, preparing the site for hardware installation, and taking delivery of, installing and accepting the DIGITAL minicomputer.

This document is preceded by a document which presents guidelines for producing a feasibility study for minicomputers, and is succeeded by a document which presents guidelines for minicomputer operations. Additional information may be obtained from the Project Officer at the Management Information and Data Systems Division in Washington, DC.

I. ORDERING PROCEDURES

Once the minicomputer feasibility study has been submitted and approved by MIDSD and funding has been arranged, the requesting group can begin the procurement process. All contracting actions should be coordinated through MIDSD. Prior to placing orders for hardware and related services, the requesting group should become familiar with the specifications associated with the contract established between DIGITAL and EPA (Contract No. 68-01-3801).

1. MINICOMPUTER EQUIPMENT MAY BE PURCHASED OR LEASED.

Minicomputers may be acquired either through a one-time purchase or a monthly lease. Although the decision to purchase or lease a minicomputer usually will depend on the availability of funds, GSA regulation A-76 requires EPA to present a discounted cash flow analysis of both alternatives depicting the relative economic tradeoffs of each. Exhibit 1-1, on the following page, is a sample comparison of purchase and lease alternatives using the discounted cash flow approach.

The discounted cash flow analysis is needed to compare purchase and lease costs in present value dollars because the payment schedules are different. To do the analysis, a 10% discount rate for inflation and a five year life span for the minicomputer should be assumed. All costs should be shown and subtotalled for each fiscal year. Apply the appropriate discount factor to each fiscal year subtotal by using the following formula:

$$\text{Subtotal amount} \times 1.1^{-n}$$ where n equals 1 to 5 for the respective fiscal years into the future.

Total these discounted amounts for each fiscal year to derive the appropriate figures for comparison.

Assuming all other costs are equal between the purchase and lease option, the two alternatives are compared with the purchase price of the hardware to the discounted cash flow of the lease payments. For minicomputer acquisition, the purchase option presents a significant savings over the lease option. If funding is available, EPA should purchase the minicomputer. Otherwise EPA should lease the equipment, then exercise the purchase option when the funds become available.

EXHIBIT 1-1
ENVIRONMENTAL PROTECTION AGENCY
PURCHASE VS. LEASE CASH FLOW

PURCHASE ALTERNATIVE

	FY78	FY79	FY80	FY81	FY82	Total
Minicomputer purchase	301	17	17	17	17	369
Other ADP costs	1262	622	622	622	622	3750
	1563	639	639	639	639	4119
10% discount rate	1421	528	480	436	397	3262

LEASE ALTERNATIVE

	FY78	FY79	FY80	FY81	FY82	Total
Minicomputer lease	64	128	128	128	128	576
Other ADP costs	1262	622	622	622	622	3750
	1326	750	750	750	750	4326
10% discount rate	1205	620	564	512	466	3367

For either purchase or lease requests, hardware orders should be placed on Form SF-147 and should specify items and services to be furnished, method of acquisition and source of funding. Requirements for maintenance and lease should be prepared on separate task orders. Upon receipt, DIGITAL will acknowledge each order or modification in writing to the EPA Contracting Officer. Subsequently, DIGITAL will deliver and install equipment within 180 days after the date of the order(s).

2. LEASED EQUIPMENT IS RENEWED ON AN ANNUAL BASIS.

EPA has the option to renew the lease each year. In order to exercise the renewal option, EPA must perform two steps, as follows:

- The Contracting Officer at EPA provides DIGITAL with a written notice of intention to renew at least 60 days prior to the first of October of each fiscal year.
- EPA gives DIGITAL written notice of renewal by the first of October.

3. LEASED EQUIPMENT MAY BE PURCHASED BY EPA.

EPA has the option to purchase any or all equipment at any time during the lease period. Because of a significant cost savings, this option should be exercised by EPA when funding becomes available to do so. Purchase prices are those listed in the contract less credit equal to a percentage of the aggregate payments exclusive of taxes, insurance, transportation and maintenance charges. The applicable percentages are a function of the year during which the option is exercised. Refer to ARTICLE XVIII of the contract between EPA and DIGITAL for the actual terms of the purchasing option for leased equipment.

4. REQUIREMENTS FOR MAINTENANCE SHOULD BE PREPARED ON A SEPARATE TASK ORDER.

Maintenance is not provided in the hardware or software costs for either purchase or lease and must be ordered separately.

(1) EPA Must Contract for Maintenance Service for Leased Equipment for the Duration of the Lease.

It is recommended that EPA purchase this maintenance service from DIGITAL rather than from an alternative source. Maintenance fees are provided in the contract between DIGITAL and EPA under ARTICLE VIII, Table IIA or Exhibit C, which is the price list. DIGITAL provides a maintenance service which includes both preventive maintenance and remedial maintenance. Preventive maintenance is performed during normal business hours at times convenient to both EPA and DIGITAL. DIGITAL specifies the frequency and duration of preventive maintenance. EPA and DIGITAL must set up a mutually agreeable written schedule. Remedial service is performed within 6 hours or 24 hours (exclusive of holidays and weekends) after EPA notifies DIGITAL that the equipment is inoperative. There are thirteen cities which receive the 6 hour response time, as follows:

- Washington, DC
- Research Triangle Park, North Carolina
- Cincinnati, Ohio
- Boston, Massachusetts
- New York, New York
- Philadelphia, Pennsylvania
- Atlanta, Georgia
- Chicago, Illinois
- Dallas, Texas
- Kansas City, Kansas
- Denver, Colorado
- San Francisco, California
- Seattle, Washington

All other cities will be serviced within a 24 hour period.

The maintenance service includes all parts and labor as well as travel expenses for the thirteen cities with 6 hour response time. All other maintenance locations must pay travel costs from DIGITAL's nearest service center at a rate of $.16 per mile.

(2) The Current Contract Specifies That Maintenance Be Provided on an "As Needed Basis" for Purchased Equipment.

Although maintenance must be on an "as needed basis" at the present time, a maintenance contract may be less expensive. Regular maintenance service costs approximately one percent of

the purchase price per month. The hourly rate for service on an "as needed basis" is $38 per hour during regular business hours and $44 per hour after hours. The Data Center should monitor maintenance charges and evaluate the cost effectiveness of the "as needed basis" as compared to a maintenance contract. If the analysis shows that a maintenance contract would be considerably less expensive, then EPA should amend the contract to allow for such an option.

Maintenance charges should not begin until after the 90-day warranty period beginning on the first day of the "Successful Performance Period", which occurs during initial installation. Exhibit 1-2, on the following page, shows the relevant dates and periods mentioned in the contract. While under warranty, all maintenance and replacement parts will be provided by DIGITAL free of charge to EPA. A maintenance contract during this period is redundant and should be avoided.

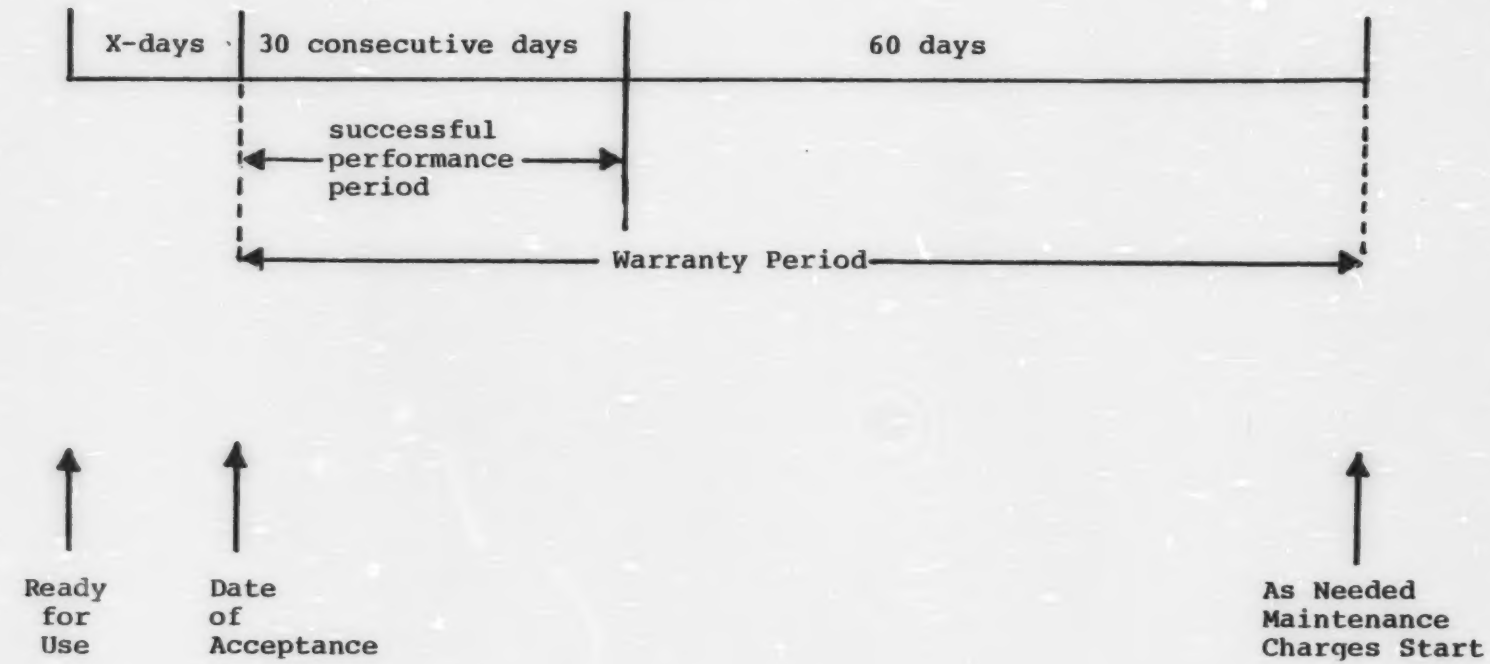
5. OPERATIONAL SUPPLIES MAY BE PURCHASED AT LOWER COST FROM ALTERNATE VENDORS.

Operational supplies, such as additional disk packs, tapes, and printer paper and ribbons, are generally less expensive when acquired from vendors that provide DIGITAL compatible peripherals and supplies. If, however, EPA chooses to purchase supplies from DIGITAL, the supplies must be ordered separately. Supplies are not included in any DIGITAL charges, with three exceptions, as follows:

- One disk pack is provided with each disk drive
- Two tape reels are provided with each magnetic tape drive
- One ribbon is provided with each line printer

For further information concerning procurement procedures, the requesting group should contact the Project Officer at MIDSD.

EXHIBIT 1-2
ENVIRONMENTAL PROTECTION AGENCY
CONTRACTURAL DATES AND PERIODS



II. IMPLEMENTATION PLAN

An implementation plan must be produced in order to insure smooth minicomputer installation and program conversion. An implementation plan is the basis for control and review and leads to improved project structuring, planning, estimating, analysis, and communication among project participants. The plan also provides the project with information necessary to anticipate problems before they occur and to develop solutions.

The future Data Center Manager generally should complete the implementation plan and submit it for approval to MIDSD within three weeks following acceptance of the feasibility study.

The first step in preparing the plan is to identify all the implementation phases and to prepare a more detailed plan for each phase. There are seven phases in most minicomputer implementation projects, as follows:

- The conversion design phase includes analysis for changing programs and for conducting the actual conversion.
- The hardware installation phase includes site preparation, delivery, installation and acceptance testing of the PDP 11 equipment.
- The programming phase includes recoding modules that require changes due to the differences in the program languages on the two machines. This phase includes also unit testing of all modules being converted.
- The integration and system test phase includes thorough testing of the software that is being converted.
- The acceptance test phase is a formal test that results in the acceptance of the converted application and signifies application readiness for switchover to the minicomputer.
- The conversion phase includes the physical cutover from the existing system to the minicomputer. This phase may include pilot/operations or parallel processing as well.
- The operation and maintenance phase is the daily processing of systems on the minicomputer and maintenance of hardware and software, as needed, when problems arise.

Appendix A includes checklists for each phase. The checklists outline the major activities, assumptions and resources required in each phase.

The characteristics of an EPA minicomputer implementation plan should include seven components for each phase, as follows:

- Assumptions
- Work products and major activities
- Resource requirements and task estimates
- Task priorities and interdependencies
- Schedule
- Budgets
- Milestones

This chapter presents descriptions and samples of each component of the plan.

1. ASSUMPTIONS IDENTIFY THOSE UNCERTAINTIES THAT COULD CAUSE THE IMPLEMENTATION PLAN TO CHANGE SIGNIFICANTLY.

   The Assumptions section of the plan provides a checklist of situations that must be considered during planning and should be monitored at regular intervals throughout the development process. An assumption proven false may require immediate management action including revision of the implementation plan itself. Exhibit 2-1, on the following page, contains a sample list of assumptions. Appendix A shows typical assumptions for each phase.

2. WORK PRODUCTS AND MAJOR ACTIVITIES PROVIDE THE FOUNDATION FOR TASK AND MILESTONE IDENTIFICATION.

   Define the work products and major activities for each phase. They provide a structure from which the planner can identify smaller, controllable work units called tasks. This structure identifies also the intermediate development goals which will become milestones. Work products are tangible outputs, such as program conversion specifications, training plans or site preparation plans. Major activities are those efforts required to produce the work products. Major activities include also general categories such as project administration or review. Appendix A shows the major activities of a typical minicomputer implementation.

EXHIBIT 2-1
ENVIRONMENTAL PROTECTION AGENCY
SAMPLE ASSUMPTIONS

1. Conversion of Application A will involve no functional definition change.

2. DIGITAL will deliver the equipment by MM/YY and the acceptance performance period will be completed by MM/YY.

3. On site training by DIGITAL will be performed according to the following schedule:

4. Test data from the previous system will be available MM/DD/YY.

5. Computer time and the personnel indicated will be available on the previous system to facilitate conversion to the minicomputer during the period from MM/DD/YY to MM/DD/YY.

For EPA installations that are converting several applications to the minicomputer, each application should be considered as a separate work product in each phase. The applications that should be converted first and therefore given the highest priority are those with the highest economic return. This information is identified in the feasibility study. For example, if text editing is being converted to the minicomputer, it can start shortly after acceptance of the hardware. The work product is the training plan for the operators and the major activity is the actual training.

3. RESOURCE REQUIREMENTS MUST BE IDENTIFIED AND TASKS MUST BE ESTIMATED BEFORE THE IMPLEMENTATION PROJECT CAN BE SCHEDULED.

The resources that must be identified are personnel, computer equipment, operations software for development and testing, and major expense items, such as extra training, travel, or special equipment. Once the resources have been identified, the length of time it will take to complete each task must be estimated. Exhibit 2-2, on the following page, shows the resource requirements and task estimates for sample tasks.

4. PRIORITIES MUST BE ESTABLISHED AND TASK INTERDEPENDENCIES MUST BE RECOGNIZED.

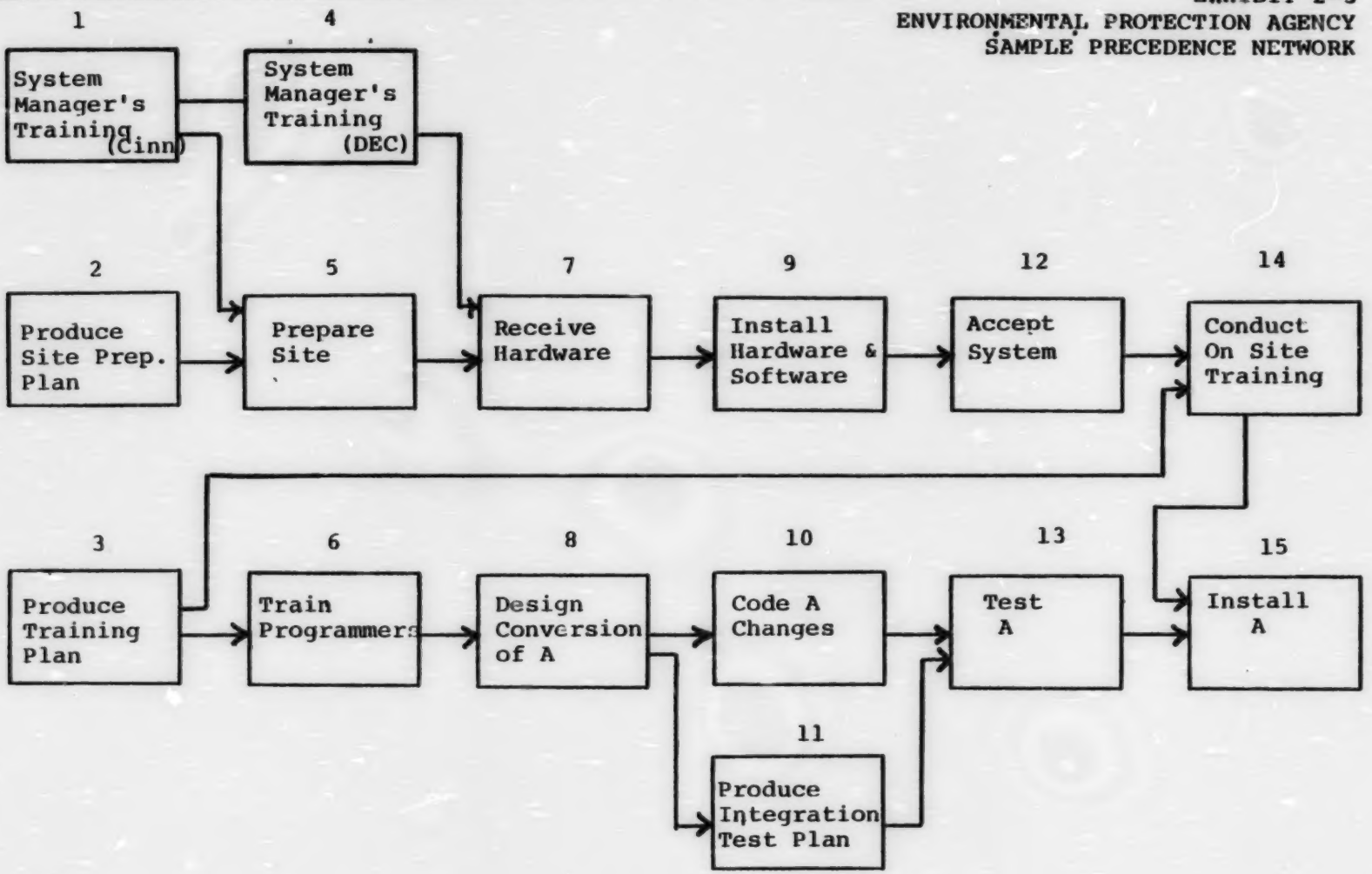
Before a schedule can be plotted, the priority of tasks must be established, and the interdependencies among tasks must be identified. For most plans a simple list of priorities and interdependencies is sufficient. For complex problems with short time frames, a precedence network is helpful. Precedence networks provide direct visual determination of project interdependencies and interrelationships. Exhibit 2-3, on the page following Exhibit 2-2, is a sample precedence network. The boxes represent tasks and the time required to accomplish each. The lines represent precedence requirements. The two lines entering Box 5 from the left connect two tasks (1 and 2) that must be completed before task 5 can begin. Precedence networks identify tasks that can occur independently of all other tasks, and tasks that have predecessors. Successors of tasks also are shown.

It is the priorities and interdependencies that suggest the order in which tasks should be scheduled. Precedence requirements provide also a basis for critical path analysis and suggest a plan for corrective action when the schedule is not met. These two features are an important tool for project control.

EXHIBIT 2-2
ENVIRONMENTAL PROTECTION AGENCY
SAMPLE TASK LIST

TASK CODE	TASK DESCRIPTION	ESTIMATED BUDGET IN HOURS	RESOURCE REQUIREMENTS
100	Delivery, Installation & Acceptance		
110	Plan Acceptance Test	80	System Manager, Analyst
115	System Manager Training (DEC)	80	System Manager
120	Receive Hardware	8	System Manager
125	System Manager Training (Cinn)	20	System Manager
130	Install Hardware and Software	40	System Manager
135	On Site Training	40	System Manager, Programmers, Operators
140	Perform Acceptance Test A	8	Programmer, RJE Terminal
141	Perform Acceptance Test B	8	Programmer, 3 RJE Terminals

EXHIBIT 2-3
ENVIRONMENTAL PROTECTION AGENCY
SAMPLE PRECEDENCE NETWORK



5. THE OVERALL PROJECT SCHEDULE COMBINES THE RESULTS OF THE PREVIOUS STEPS.

The tasks, the resources required to complete those tasks, the interdependencies and interrelationships of the tasks and underlying project assumptions are the basic components of the implementation schedule. These factors have to be analyzed, weighed and balanced to produce a schedule that best utilizes the resources available. The schedule takes into consideration external responsibilities, availability of resources, vacations, holidays, sick time, personnel turnover, potential interruptions, and contingency for anticipated problems. Exhibit 2-4, on the following page, is a sample schedule. The sample schedule plots the major activities against time. It lists the major tasks, indicates planned start dates and completion dates.

6. THE BUDGET INCLUDES BOTH PROFESSIONAL SALARIES AND EXPENSES.

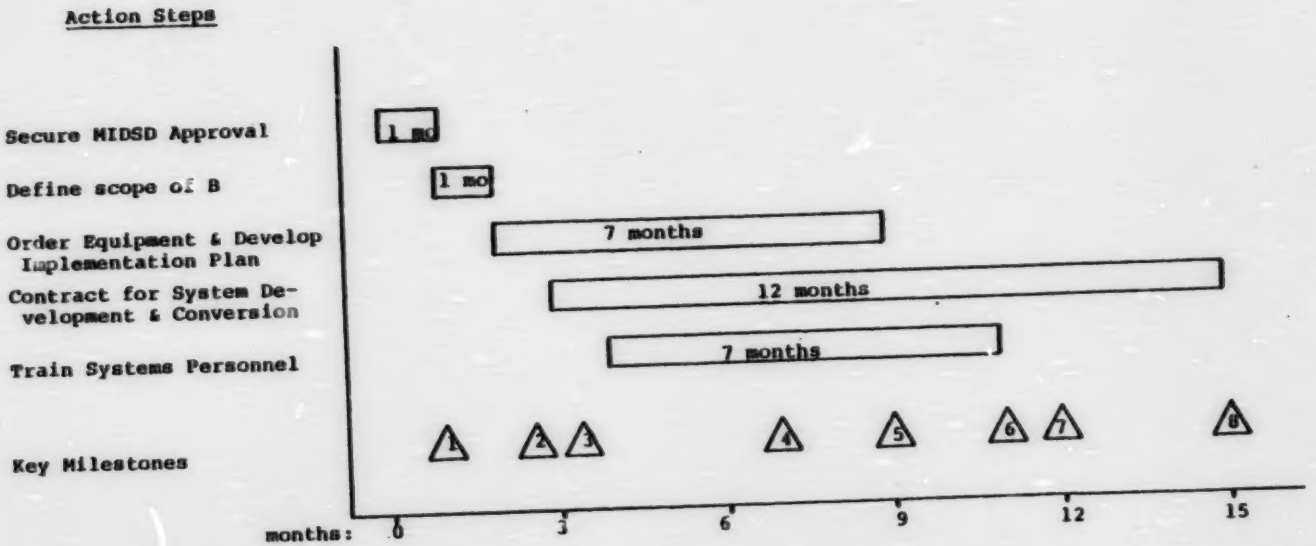
The budget always includes both professional services and expenses, but is estimated differently depending on whether the implementation is performed in-house at EPA or contracted outside. For development that is undertaken in-house, the professional budget should include salaries for all personnel involved during the implementation period, plus overhead. Major expenses will include borrowed machine time and training. For contracted work, assume the following average monthly rates per person:

Contractor-consulting and design project	$6000
Contractor-software development	$4500

Also add travel and other associated expenses, as needed. Exhibit 2-5, on the page following Exhibit 2-4, is a sample budget for contracted development.

The decision to undertake the entire development in-house or to contract outside depends primarily on the availability of EPA personnel to work on the project.

EXHIBIT 2-4
ENVIRONMENTAL PROTECTION AGENCY
SAMPLE SCHEDULE



1. Secure MIDSD Approval
2. Order Equipment
3. Issue system development & conversion contracts
4. Coordinate site preparation with hardware vendor
5. Receive and install minicomputer
6. Install data entry, text editing and A processing capabilities
7. Install B and C processing capabilities
8. Install D processing capabilities

EXHIBIT 2-5
ENVIRONMENTAL PROTECTION AGENCY
SAMPLE BUDGET FOR CONTRACTED DEVELOPMENT

	Estimated Cost	Elapsed Time	Basis for Cost
Package A selection and overall system design	$ 40,000	3 months	6 mm x $6,000 = $ 36,000 expenses = $ 4,000 $ 40,000
Package A detailed system design	$ 30,000	2 months	2 mm x $6,000 = $ 12,000 3 mm x $4,500 = $ 13,500 expenses = $ 4,500 $ 30,000
Package A programming and unit test	$100,000	5 months	4 mm x $6,000 = $ 24,000 15 mm x $4,500 = $ 67,500 expenses = $ 8,500 $100,000
Package A full system test and installation	$ 30,000	2 months	2 mm x $6,000 = $ 12,000 3 mm x $4,500 = $ 13,500 expenses = $ 4,500 $ 30,000
Package B system design, programming and installation	$ 30,000	4 months	1 mm x $6,000 = $ 6,000 4.5 mm x $4,500 = $ 20,250 expenses = $ 3,750 $ 30,000
Training cost	$ 25,000	12 months	1 EPA manyear equivalent
Site preparation	$ 10,000	2 months	

7. MILESTONES ARE SIGNIFICANT POINTS IN DEVELOPMENT THAT PROVIDE CHECKPOINTS FOR CONTROL.

Significant points in the implementation plan are called "milestones". Milestones are measurable units and coincide with the completion of project phases, work products or major activities. Six sample milestones are, as follows:

- DIGITAL equipment installation
- System Manager Manual
- Acceptance of PDP 11 system
- Application A coding complete
- Application A integration test complete
- Operations manuals complete

Milestones should be indicated on the implementation schedule. Milestones also provide checkpoints for control. Completion and delivery of tangible outputs provide concrete evidence of adherence to or deviation from the schedule.

The previous seven points in this chapter describe the format of the implementation plan to be produced. This, in conjunction with Appendix A, should provide enough data to develop a computer plan that identifies all the major activities and work products of a minicomputer implementation. The resulting product is a schedule and a budget that must be presented to the Project Officer for approval. Once approved, tasks should be assigned according to the schedule, and the entire plan should be monitored closely.

In order to monitor progress effectively, management controls must be established. These controls include development of formal policies and procedures, coordination with Headquarters, progress reporting and plotting of actual results against planned results. The progress report, which becomes a primary tool for monitoring the progress, should contain seven sections, as follows:

- Implementation accomplishments
- Resource personnel usage
- Vendor/MIDSD support
- Assessment/findings
- Problems resolved
- Problems unresolved
- Deviations from plan and impact on subsequent activities

The progress report records completed tasks, highlights deviations and problems and provides historical data. If problems arise, management is alerted quickly and can take corrective action. Planning and control that follow the guidelines presented in this chapter will reduce the risk of a delayed implementation and help lead the way to a smooth conversion.

III. TRAINING

EPA personnel must undergo training to learn how to operate the new minicomputer system and to prepare for the changes that the minicomputer will impose upon current operations. Cincinnati provides a pre-installation training course. DIGITAL provides some training free of charge at the time of installation. More training is available from DIGITAL for a fee. EPA will need to conduct additional training in order to communicate the new procedures to user personnel.

1. A TRAINING PLAN IS REQUIRED.

EPA must plan a training program that will teach the personnel how to utilize the capabilities of the minicomputer system and how to operate, design and program new applications. Planning includes an evaluation of the training alternatives and a selection of a training approach. Four parameters of training must be considered, as follows:

- Personnel to be trained
- Course content
- Training resources required
- Training methodology

Once these parameters have been evaluated, a training plan should be created.

(1) The Plan Must Identify the EPA Personnel to be Trained.

The plan should identify who will be trained and to what extent, who will attend the DIGITAL courses and who will perform internal training. General information should be communicated to each person who is affected by the minicomputer. Such a training seminar should include three topics, as follows:

- Reasons for acquiring a minicomputer
- Effects and benefits it will have on EPA
- Requirements it will make on EPA personnel

Beyond the overview, different personnel will have varying training requirements, depending on their functions within EPA. Personnel training requirements include seven categories, as follows:

. Senior Management

- Broad overview of minicomputer and applications
- Benefits of minicomputer to EPA

. Operations Management

- Functions of the minicomputer
- Effect minicomputer will have on work-flow

. System Manager

- IAS concepts
- Familiarity with DIGITAL manuals and hardware in preparation for the system managers course at DIGITAL (Cincinnati provides a two-day tutorial program for this purpose)
- Utilities and diagnostic aids
- Backup, recovery and restart procedures
- Operational procedures
- Maintenance procedures
- Trouble reporting to DIGITAL

. Programmers

- IAS concepts
- Specific languages as implemented on the PDP 11
- Data Base Management System Features
- Understanding of the applications to be converted to the minicomputer
- Development standards and procedures

. Data Preparation Personnel

- Text editing on the PDP 11
- Terminal usage
- Data preparation procedures

. Computer I/O Control Personnel

- Procedures for setting up, monitoring and controlling jobs
- Distribution of output

. Operations Personnel

- Operations standards and procedures
- Normal processing of applications
- Distribution of output
- Familiarity with PDP 11 equipment, utilities and special programs

These categories and training requirements apply to all installations. However, each minicomputer system will have unique requirements based on how the PDP 11 is to be used. The training plan should include also any special training required.

(2) <u>The Plan Must Define the Courses to Be Taught</u>.

The course content must be identified and should be modular so that the personnel spend time training only in applicable areas. The courses might be broken down into twenty-one separate training areas, as follows:

. Broad overview of minicomputer and applications
. Benefits of minicomputer to EPA
. PDP 11 concepts and facilities
. IAS concepts
. Hardware diagnostics
. Command Languages

- Set up of accounts, privileges and schedule
- Utilities
- Compilers, editors and debug tools
- Operational procedures and general user interaction
- Operation of emulators
- System manager responsibilities
- Sysgen procedures
- Software installation and system patching
- Maintenance procedures and trouble shooting
- Development and execution of specific Languages (COBOL, FORTRAN)
- Data base management
- Operations management
- Operations
- Data preparation
- Specific applications that are to be implemented on the minicomputer

Of these training areas, some should begin before installation while others must occur after installation.

The training plan should include course outlines which summarize the contents of each course, a precedence network which shows the prerequisites for each course, an attendance chart which shows who should attend each course, and a course schedule. Exhibit 3-1, on the following page, presents a sample course outline for a DIGITAL-provided course.

This course outline format is recommended for all EPA-taught minicomputer training sessions. A reading list should be appended to the course outlines, where applicable. Exhibit 3-2, following Exhibit 3-1, is a sample precedence network which shows the course flow for different students. Exhibit 3-3, following Exhibit 3-2, shows a sample attendance chart. Exhibit 3-4, following Exhibit 3-3, is a sample schedule for the training program.

(3) <u>The Plan Must Identify the Training Resources Required</u>.

Once the courses have been identified, the resources required to conduct on-site training must be listed. There are four general categories of resources that should be considered, as follows:

EXHIBIT 3-1
ENVIRONMENTAL PROTECTION AGENCY
EMULATOR COURSE OUTLINE

IAS WITH UNIVAC 1004 or IBM HASP EMULATION

Course Abstract

This course is designed for the operator or entry level IAS user. It will cover daily operation of the IAS system as well as the program development procedures.

Prerequisites

A working knowledge of the material contained in "Introduction to Minicomputers" as well as at least one of the available languages: MACRO, FORTRAN, COBOL and BASIC.

Course Objectives

- Operate the PDP-11 hardware running IAS
- Interact with the system via the Program Development System
- Develop Programs using MACRO-11 or FORTRAN IV

Course Outline

I. System Overview
   A. Front Panel Operation
   B. Starting Up the System
   C. Configuration

II. Console Operations
   A. PDS Commands
   B. Commands to Initiate Real-Time Tasks

III. Program Development
   A. Editor
   B. Macro (Implementation Only)
   C. FORTRAN (Implementation Only)
   D. Taskbuilder (Linker)
   E. On-Line Debugging Technique (for Macro programs)

IV. Executive Directives

V. General Utilities
   A. PIP
   B. FLX
   C. LBR
   D. VFY

VI. Overview of I/O Services
   A. Queue I/O
   B. File Control Services

VII. Real-Time Considerations
   A. Scheduling
   B. Priorities

VIII. Program Use of HASP Emulator

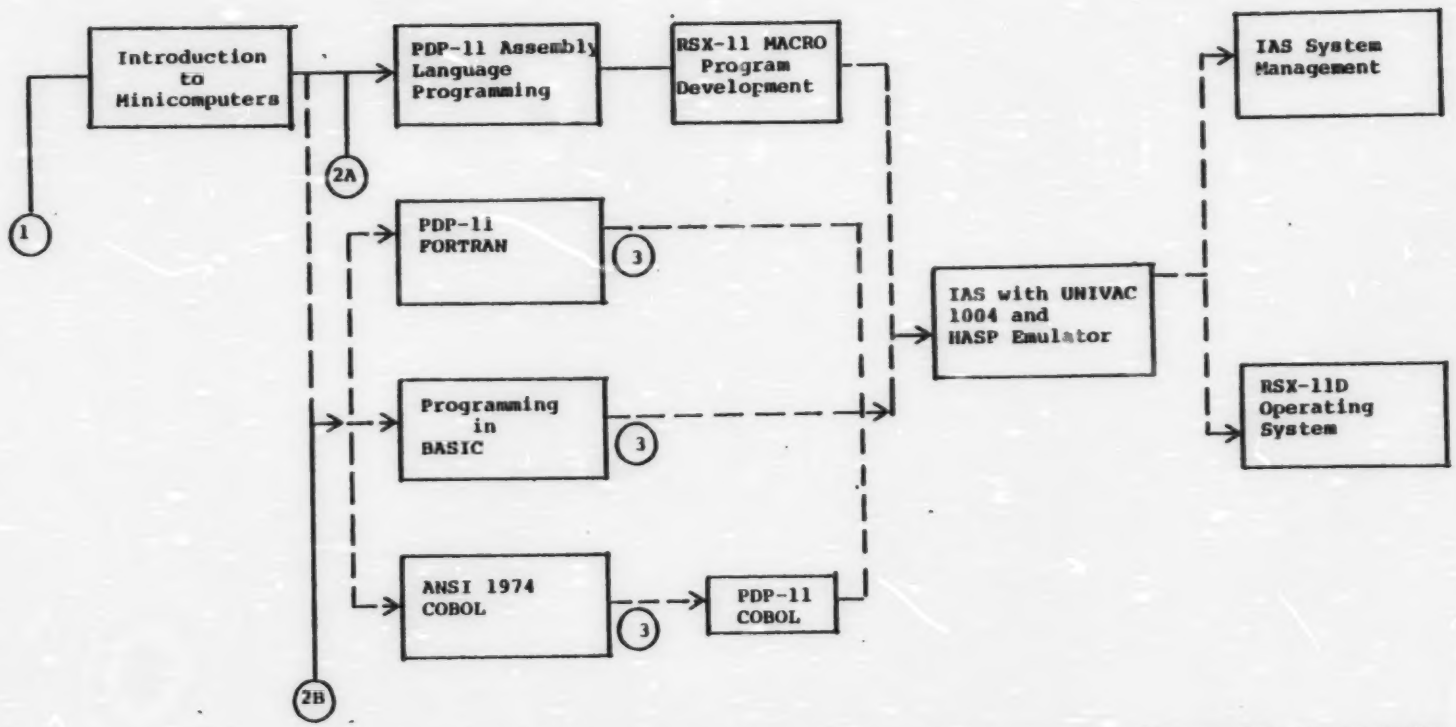
IX. Program Use of UNIVAC 1004

Course Length

5 days (40 hours)

EXHIBIT 3-2
ENVIRONMENTAL PROTECTION AGENCY
DIGITAL COURSE FLOW PRECEDENCE NETWORK

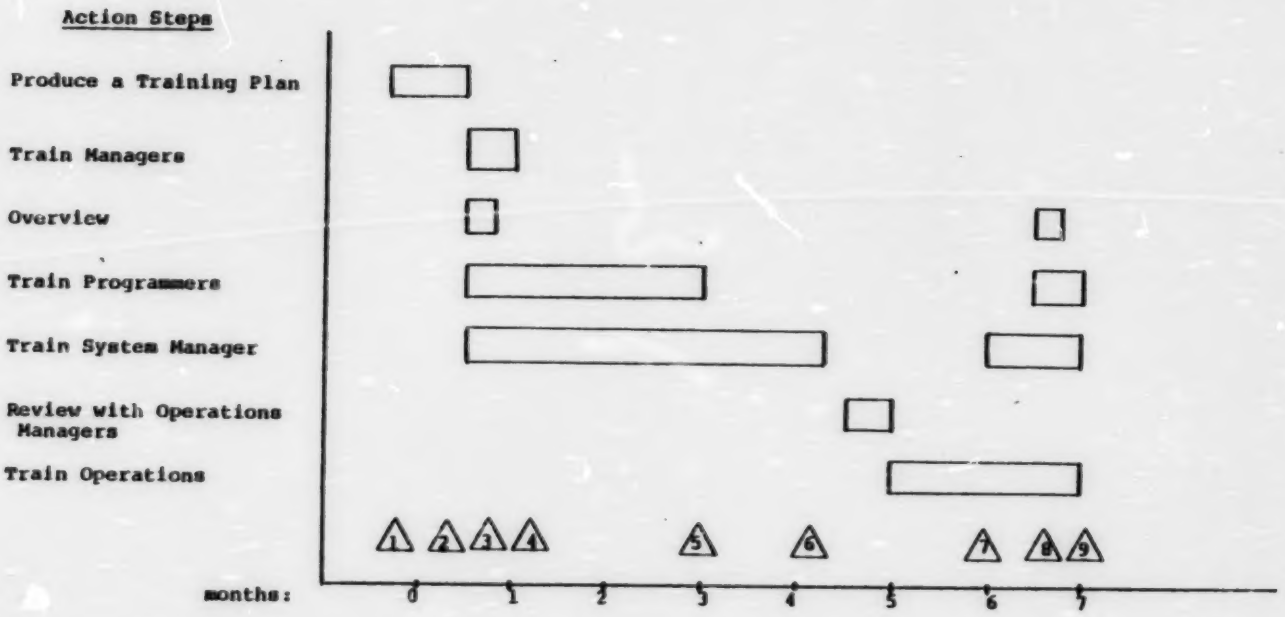
COURSE FLOW



1. Starting point for individuals with no computer experience or for programmers with compiler level background only.
2A. Starting point for individuals with previous assembly language experience but no knowledge of the PDP-11.
2B. Starting point for individuals with no previous compiler experience.
3. Starting point for high-level language programmers who have no experience with PDP-11.

	OPERATORS	SYSTEM MANAGER	COBOL PROGRAMMER	BASIC PROGRAMMER	FORTRAN PROGRAMMER	MACRO-11 PROGRAMMER
INTRODUCTION TO MINICOMPUTERS		X	X	X	X	X
PDP-11 ASSEMBLY LANGUAGE PROGRAMMING						X
RSX-11 MACRO PROGRAM DEVELOPMENT						X
PDP-11 FORTRAN					X	
PROGRAMMING IN BASIC				X		
ANSI 1974 COBOL			X			
PDP-11 COBOL			X			
IAS WITH UNIVAC 1004 AND HASP EMULATOR	First 20 hours	X	X	X	X	X
IAS SYSTEM MANAGEMENT		X				
RSX-11D OPERATING SYSTEM						X

EXHIBIT 3-4
ENVIRONMENTAL PROTECTION AGENCY
SAMPLE TRAINING SCHEDULE



1. Equipment is ordered
2. Training Plan Completed
3. General Overview Presented to Everyone
4. Managers Complete more detailed Overview Training
5. Programmer's training complete. The first 2-4 weeks of training is intense, then the training gradually drops off as the programmers become more proficient with the new programming techniques.
6. System managers training suspended until installation. System managers training also drops off after the first 4 weeks.
7. System installed
8. General overview repeated and changed
9. System managers, operations and programmers on site training complete

- An available PDP 11 system with the appropriate operating system, language compilers and other software requirements
- Classrooms
- Instructors
- Materials, such as charts, projectors and slides, blackboards, handouts, manuals and sample forms

Analysis of the training resource requirements provides the planner with a checklist for making the appropriate arrangements to obtain these resources.

(4) A Training Methodology Should Be Considered.

Although attendance, course content and resource requirements are the primary components of the plan, some thought should be given to the general training methodology. There are four factors to be considered, as follows:

- Size of the meetings
- Presentation format, such as general meetings, seminars, or workshops
- Feedback requirements and mechanisms
- Length and timing of training sessions

The size of a training meeting depends on the amount of detail covered, the amount of specific information covered, and the amount of training tools available. A large meeting is appropriate for overviews of PDP 11 concepts, facilities and IAS concepts. On-site training should be scheduled only for three or four persons at a time. The other training sessions are best suited to a workshop environment, which schedules up to eight persons at a time for six hours a day.

Feedback is important for all training sessions. Formal verbal and written feedback should be encouraged in the early stages, half way through and at the end of the training sessions.

Timing considerations depend mainly on when the EPA personnel require the information to do their jobs. Where possible, personnel should not be trained more than two to four weeks before they are to use the information acquired. Otherwise, the training will not be effective. If another PDP 11 is available for testing, the programmers should start immediate training so that they can begin converting their own programs. Operations staff should begin training just prior to installation. The training plan should assume that installation will take place six months after the order is submitted to DIGITAL.

2. CSSD SHOULD BE A MAIN RESOURCE FOR TRAINING.

EPA's Computer Services and Systems Division (CSSD) at Cincinnati provides an intensive two day training course for prospective system managers. The course is designed to provide an introduction to the EPA minicomputer system and to establish the appropriate technical dialogue in preparation for DIGITAL training and installation. Exhibit 3-5, on the following page, outlines the course content. The prospective system manager should make arrangements with CSSD for attending the course within one month of the anticipated arrival of the system. It is estimated that this course will save one to three weeks of "wheel spinning".

In addition, CSSD is available for telephone consulting. CSSD should be contacted regarding technical questions or problems. They maintain a central file for all EPA minicomputer installation problems. From this log and experience they are able to resolve specific questions often faster than DIGITAL.

3. TRAINING PROVIDED BY DIGITAL IS AN INTEGRAL PART OF THE TRAINING PLAN.

The training that DIGITAL provides is significant and should be incorporated as an integral part of the training plan. The amount of free training EPA may receive from DIGITAL depends on the hardware and software configuration ordered. Within 90 days following any CPU installation, DIGITAL must provide on-site

EXHIBIT 3-5
ENVIRONMENTAL PROTECTION AGENCY
EPA SYSTEM MANAGERS COURSES

TWO DAY INTERNAL EPA COURSE
FOR PDP11 SYSTEM MANAGERS

DAY I, TIME:	TOPIC
8 AM - Noon	System overview: Hardware diagnostics use; PDS commands, SCI commands; privileges; setting up accounts for users; operation of emulators, compiler, utilities, and proposed standards
1 PM - 5 PM	IAS sysgen procedures
7 PM - on	Playtime

DAY II, TIME:	
8 AM - 10 AM	FORTRAN IV PLUS installation
10 AM - noon	Univac 1004 emulator installation
1 PM - 3 PM	HASP emulator installation
3 PM - on	Playtime

training for up to 12 EPA personnel. The course will consist of a minimum of twenty hours of operations training and a minimum of twenty hours of software training. The EPA Project Officer must arrange specific dates, times, classroom locations and attending EPA personnel.

In addition to the installation training, DIGITAL provides training services for software acquired with the system. Each software package has an associated number of training credits which may be applied to the DIGITAL courses. RSX-11M has three (3) training credits and IAS has five (5) training credits. These training credits should be applied to the list of courses outlined in Exhibit 3-6 following this page.

All DIGITAL prerequisites, schedules and course descriptions are described in EDUCATIONAL PRODUCTS SERVICES CATALOGUE with the exception of the course entitled "IAS with UNIVAC 1004 or IBM HASP Emulators", which is described above in Exhibit 3-1. It should be noted that this course satisfies any "course x" or "IAS Timesharing and Batch Use" prerequisite for the IAS user.

All software courses will be given at DIGITAL's Regional Training Facilities, with the exception of "IAS with UNIVAC 1004 or IBM HASP Emulators", which will be given on-site after system installation. In accordance with ARTICLE XXVII of EPA Contract No. 68-01-3801, the course entitled "IAS with UNIVAC 1004 or IBM HASP Emulators" shall be completed 90 days following installation. With the exception of the on-site emulator course, DIGITAL's local sales office will coordinate and schedule the software courses with EPA. On-site courses must be arranged through either the DIGITAL office in Maynard, Massachusetts or one of the four regional training centers, as follows:

- Lanham, Maryland
- Rolling Meadows, Chicago, Illinois
- Blue Bell, Pennsylvania
- Sunnyvale, California

The training guidelines, as outlined by DIGITAL, in conjunction with the general guidelines outlined in this chapter, should provide the project with an adequate checklist for producing a detailed training plan.

EXHIBIT 3-6
ENVIRONMENTAL PROTECTION AGENCY
DIGITAL COURSE LIST

COURSES

Course No.	Course Title	No.of Days	Price/ Student	Training Credits	Page**
JAS04-A	Introduction to Minicomputers	5	$395	1	29
JJS19-A	PDP-11 Assembly Language and Programming	5	395	1	34
JJS29-A	RSX-11 MACRO Program Devel.	5	450	1	91
JAS01-A	PDP-11 FORTRAN	3	290	1	41
JAS05-A	Programming in BASIC	3	290	1	42
JAS06-A	ANSI 1974 COBOL	5*	395	1	44
JJS24-A	PDP-11 COBOL	7	560	2	45
JKS02-A	IAS System Management	5	450	1	108
JJS27-A	RSX-11D Operating System		450	1	97

* Estimated -- see course description. This is a self-paced course.

** Page number of Educational Services Catalogue

IV. SITE PREPARATION

This chapter describes the procedure for planning the physical arrangement of the EPA minicomputer installation. In planning the minicomputer site, there are seven components to be considered, as follows:

- Computer equipment configuration
- Air conditioning facilities
- Power supply, communications and/or connector requirements
- Disk and tape library
- Cabinets and furniture
- Site access
- GSA requirements

Throughout the minicomputer site planning and preparation process, DIGITAL field representatives should be consulted for DIGITAL requirements and recommendations concerning the machine room configuration. DIGITAL will furnish site preparation specifications in writing based on environmental information supplied by EPA. In accordance with the specification supplied by DIGITAL, EPA will prepare the site at its own expense. Subsequently, DIGITAL may inspect the site and report to EPA on the acceptability of the preparations. Any alterations or modifications in site preparation which are attributable to incomplete or erroneous specifications provided by DIGITAL are to be made at the expense of DIGITAL. However, this liability excludes those conditions resulting from incomplete or erroneous information supplied by EPA.

1. THE EQUIPMENT LAYOUT IS THE MAJOR CONSIDERATION IN PLANNING THE COMPUTER ROOM.

The computer equipment has specific layout requirements which must be supported in the site plan. There are four factors to be considered, as follows:

- Minimum space required for hardware and efficient workflow
- Space around units required for servicing
- Maximum permitted connecting cable lengths
- Floor load restrictions

All these factors are interrelated and should be considered together.

The standard EPA PDP 11 minicomputer system requires a minimum space of 20 x 17 feet and a minimum ceiling height of 8 feet. Exhibit 4-1, on the following page, contains the floor layout specification by which DIGITAL will build and test a standard system. Additional equipment requires additional space. Units should be positioned to facilitate normal flow of work through the computer room. They should be placed far enough apart to provide operators ample work space but still be close enough together so that indicator panels can be read easily. In addition, sufficient space should be available for the DIGITAL field representative to service equipment. The dashed lines in Exhibit 4-1 indicate the required service area for each piece of equipment.

DIGITAL recommends but does not require raised flooring. The support characteristics of a false floor may limit the number of possible equipment arrangements. For example, if heavy air conditioning units are in close proximity to a DIGITAL mainframe, the resulting stress on a nearby false floor support pillar might exceed manufacturers specifications and cause the floor to collapse.

The DIGITAL Site Preparation Kit and Site Preparation Handbook should be used to layout equipment. DIGITAL field representatives should be consulted for DIGITAL requirements and for recommendations concerning equipment configuration.

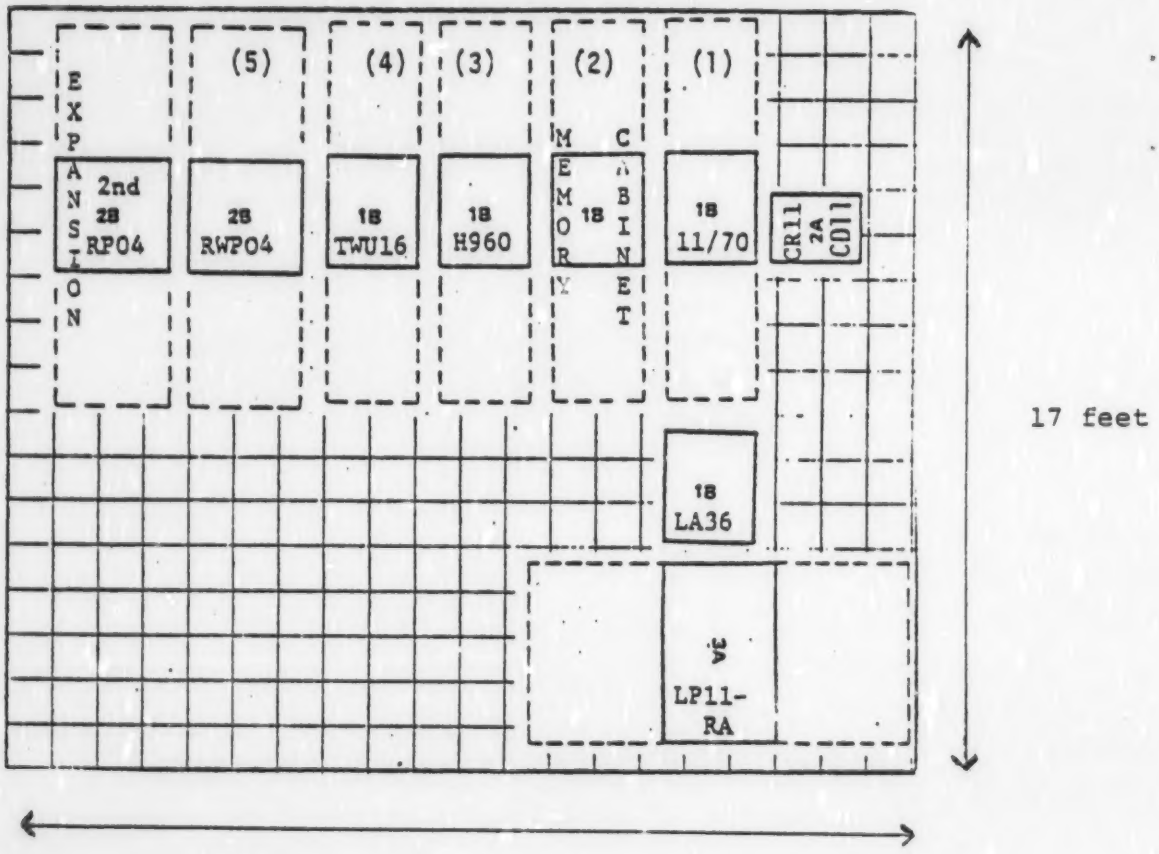
2. AIR CONDITIONING FACILITIES MUST BE PROVIDED TO CONTROL THE OPERATING ENVIRONMENT.

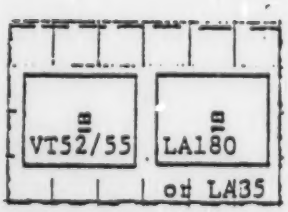
Computer room air conditioning equipment must control adequately the room temperature, humidity and dust content. PDP 11 data centers should be operated in the following temperature/humidity range:

	MACHINE OPERATING OPTIMUM	MACHINE NON-OPERATING
Temperature	65° to 80° F	50° to 110° F
Humidity	40% to 60%	8% to 80%

EXHIBIT 4-1
ENVIRONMENTAL PROTECTION AGENCY
MINIMUM SPACE REQUIRED

Minimum Required Floor Layout
for Standard EPA Minicomputer System





← optional devices

minimum room size = 17 FT x 20 FT
minimum ceiling height = 8 FT

For human comfort, a temperature of 68 degrees and a humidity of 45% is optimal. A temperature and humidity recorder should be installed in close proximity to the PDP 11 to enable the operator to insure that the machine room environment falls within these ranges.

Dust content is controlled by filters within the air conditioning system. Because these filters must be replaced periodically, easy access to the air conditioning unit must be provided.

The design and selection of the appropriate air conditioning system should be based upon technical recommendations of the DIGITAL field service representative and a competent heating/ventilation expert. The amount of air conditioning required is dependent on the heat generated by all the equipment to be installed in the computer room. Exhibit 4-2, on the following page, shows the amount of heat generated by various DIGITAL hardware components. Exhibit 4-3, following Exhibit 4-2, shows the operational environment for those components. Because it is the responsibility of EPA site managers to maintain the operating environment within the specified limits, air conditioning units should be considered carefully.

3. POWER SUPPLY, COMMUNICATIONS AND CABLE CONNECTOR REQUIREMENTS MUST BE DETERMINED.

DIGITAL will specify the power supply, communications and cable/connector requirements for each PDP 11 minicomputer system to be installed. These requirements should allow for the potential expansion of data processing equipment. It is the responsibility of EPA to install the specified electrical and communications equipment prior to delivery of the system. An electrical contractor and communications contractor should be engaged if the data center is not set up to handle the minicomputer requirements. MIDSD has site preparation guidelines which contain DIGITAL-specified requirements for circuit breakers, communications and cable lengths. Contact MIDSD for current specifications.

The power supply to the computer room should be separated from power supplies to other non-ADP equipment. In addition, stand-by power systems may be required if the primary power supply is unstable.

EXHIBIT 4-2
ENVIRONMENTAL PROTECTION AGENCY
HEAT GENERATED BY HARDWARE COMPONENTS

COOLING REQUIREMENTS

DEVICE	HEAT DISSIPATED IN BTU'S/HOUR PER DEVICE
11/70-NA includes LA36 Console	12,000
DU11	78
FP11-C	200
MJII-BA	1,750
MJII-BE	1,750
CR11/CD11	1,365/2,046
RWP04-AA (RP04-AA)	7,000
TWU16-EA (TU16-EE)	3,412
LP11-RA	6,820
DZ11-E or DH11-AD	237
KG11-A	20
DQ11-DA	100
VT52/VT55	444
LA35 (MAXIMUM)	1,023
LA180 (MAXIMUM)	1,364

EXHIBIT 4-3
ENVIRONMENTAL PROTECTION AGENCY
OPERATING ENVIRONMENT REQUIREMENTS

OPERATING ENVIRONMENT

ITEM NO.	MODEL NO.	TEMPERATURE °C	TEMPERATURE °F	HUMIDITY RELATIVE	HUMIDITY MAX WET BULB	MINIMUM DEW POINT
1.	11/70-NA	10 - 40	50 - 104	10% to 90%	28°C(82°F)	2°C(36°F)
2.	FP11-C	SAME		SAME		
3.	MJ11-BA	AS		AS		
4.	MJ11-BE	11/70 VA		11/70 VA		
5.	CR11/CD11	10 - 50	50 - 122	20% to 80%	N/S	N/S
6.	RWP04-AA	16 - 32*	60 - 90*	5% to 90%	N/S	N/S
7.	TJU16-EA	15 - 32	59 - 90	20% to 80%	N/S	N/S
8.	DP11-RA	10 - 40	50 - 104	10% to 90%	N/S	N/S
9.	DZ11-E/ DH11-AD	5 - 45	41 - 114	0% to 95%	N/S	N/S
10.	DQ11-DA	10 - 43	50 - 110	0% to 90%	N/S	N/S
11.	KG11-A	10 - 50	50 - 122	0% to 90%	N/S	N/S
12.	DU11-DA	10 - 50	50 - 122	0% to 95%	N/S	N/S
13.	VT52-AE	10 - 40	50 - 104	10% to 90%	28°C(82°F)	2°C(36°F)
14.	VT55-FE/EE	10 - 40	50 - 104	10% to 90%	28°C(82°F)	2°C(36°F)
15.	LA36-CE	10 - 40	50 - 104	10% to 90%	N/S	N/S
16.	H960-DH	10 - 50	50 - 122	N/S	N/S	N/S
	SYSTEM OPERATING LIMITS	16 - 32	60 - 90	20% to 80%	28°C(82°F)	2°C(36°F)

* MAXIMUM RATE OF CHANGE = 8°C(15°F)/HR.

N/S = NOT SPECIFIED

4. STORAGE SPACE FOR A DISK AND TAPE LIBRARY MUST BE PLANNED.

The computer room should include space for a disk/tape library. The disk/tape library consists of a number of tape reel/disk storage racks or fireproof cabinets. As a general rule, the disk/tape library should be located within the same air conditioned environment as the computer room. In allocating space, enough room should be provided to accommodate growth of tape-oriented systems.

The library should be subject to the same safety and emergency considerations as the computer room. Because the use of fireproof cabinets can do much to prevent loss of data in the event of a fire, provision must be made for a separate backup vault or storage area for master files and programs. Additional fire precautions can be taken by locating those disks and tapes, which should be given priority for removal in case of fire, in a special reserved area of the library. In addition, since security in the disk/tape library is an important consideration, the operator should use locking storage cabinets.

5. CABINETS, FURNITURE, AND MISCELLANEOUS EQUIPMENT MUST BE CONSIDERED.

The minicomputer site should contain a limited amount of cabinets, furniture, and miscellaneous equipment. Where possible, these furnishings should be kept to a minimum. Extra desks, chairs, and cabinets generate unnecessary dust and clutter.

Storage furniture should consist of a table or counter for input, a table for work in progress, and bins or cubby-hole shelves for temporary output storage. Cabinets should store only enough supplies of paper, cards, reference manuals and other operations materials to support several weeks of work. Magnetic tape racks should be present near the computer to accommodate tapes necessary for the shift's operations. Other tapes should be stored in the tape library.

Computer rooms should include also the following equipment:

- Accurate electric clock visible from the operator's console
- Emergency power-off buttons located in a strategic position in the machine room
- Fire detection alarm and fire extinguishing equipment

- Temperature/humidity recorder and alarm system
- Recycling waste bins large enough to accommodate separate waste output and cards

The arrangement of computer room furnishings should facilitate the orderly processing of work.

6. ACCESS TO THE MINICOMPUTER SITE MUST BE PLANNED FOR DELIVERY AND NORMAL WORKFLOW.

Site access must be planned to take into consideration five factors, as follows:

- Workflow to and from the computer room
- Unnecessary traffic through the computer room
- Restriction of food and drink into the computer room
- Access to needed computer supplies and libraries
- Delivery of hardware and replacement equipment

These five factors have building implications on the minicomputer site.

The computer room should be arranged so that input may be delivered and output collected in an efficient manner. Usually a high input counter and an output distribution area segregated from the minicomputer equipment area will allow for efficient acquisition and distribution of work. This arrangement permits only the computer operator to have direct access to submitted materials and restricts data center users to job submittal areas.

The computer room should be positioned to discourage use as a thoroughfare by EPA personnel. A window into the computer room or glass anteroom enables visitors to see the facility without actually entering it and enables operators to observe the machine while having a snack. There must be ready access to the computer supply storage room and the tape/disk library. The size of the doors, passageways, ramps and elevators that the equipment must pass through for delivery should handle the weight, height, width and turning radius of all planned and future hardware.

7. GSA IMPOSES CERTAIN REQUIREMENTS ON THE MINICOMPUTER SITE.

GSA imposes computer center regulations that are applicable to EPA minicomputer data centers. They refer to the control of the computer room environment and associated fire safety practices. Specifically, the regulations that should be considered at the planning stage address three topics, as follows:

- Temperature and humidity
- Lighting and telephone service
- Fire prevention and equipment

Data center managers should plan the minicomputer site so that these regulations may be met. For a more complete description of GSA requirements for computer centers, refer to the Operations Guide to Minicomputer Data Centers, Chapter V, "Machine Room Environment" (Contract No. 68-01-3824).

Temperature and humidity recording and warning systems must be installed. A temperature/humidity recorder should be installed in a location that reflects accurately the condition of air entering the computer room. The doors installed in the access ways should be tightly closing doors to prevent excessive temperature and humidity fluctuations. An adequate temperature/humidity warning system should be installed so that data center personnel may take prompt action if temperature/humidity limits are approached. A temperature alarm system may be acquired through Cincinnati or elsewhere.

Lighting and telephone service must be provided. Lighting fixtures must provide a minimum illumination of 40 foot candles as measured 40 inches above the floor. Telephone service should be provided within the computer room. There should be telephones near the computer consoles to facilitate trouble shooting from remote locations. If it is anticipated that the computer room will be noisy, head sets should be considered for these telephones. Also, telephones should be provided for EPA personnel to inhibit unnecessary traffic.

Fire prevention regulations must be considered. The fire prevention regulations that affect machine room planning include clear access to all exits, emergency shutdown controls, fire-resistant materials for non-computer equipment, and fire prevention equipment. At all times clear access must be maintained to exits, alarm boxes, fire fighting equipment and emergency computer room shutdown controls.

Emergency shutdown controls cut off all electrical power to the computer and peripherals. The shutdown controls also should deactivate the air conditioning system if the system is not designed to handle smoke removal. The shutdown controls should be located at strategic points around the computer room.

All non-computer equipment and furnishings should be made of fire resistant materials. If any magnetic or paper tapes, or card decks that are not used on a daily basis are stored in the computer room, they should be enclosed in metal containers. Adequate fire fighting equipment must be available. There should be enough carbon dioxide fire extinguishers so that all computer room personnel are within 50 feet of an extinguisher. There also should be some water fire extinguishers for use on paper and wood fires.

V. DELIVERY, INSTALLATION AND ACCEPTANCE TESTING

Up to six months after the minicomputer is ordered and after the site has been prepared, DIGITAL will deliver and install the PDP 11 system. EPA then undergoes acceptance testing for a period of approximately thirty days. Once the system is running smoothly, development and production work can be shifted to the new installation.

1. WITHIN 180 DAYS AFTER THE EFFECTIVE DATE OF ORDER, DIGITAL WILL DELIVER THE ORDERED EQUIPMENT.

The contract between EPA and DIGITAL specifies that DIGITAL will deliver the hardware and software ordered within 180 days after the effective date of order. Before delivery can take place EPA must have the site prepared as specified and approved by DIGITAL (see Chapter IV for site preparation guidelines). Shipments to and from the installation locations are F.O.B. destination and are shipped "All Transportation Costs Prepaid".

DIGITAL will notify EPA of the approximate time of delivery. EPA should then check with the sales representative about a month before the estimated delivery. The equipment undergoes a complete test in the factory before it is shipped. This test sometimes uncovers equipment problems which delay delivery. Coordination with the sales representative will help assure on-time delivery and provide EPA with a more accurate and earlier delivery date. Before the system arrives, EPA will receive a Notification of Shipment. The project manager should compare this notification to the order to check for accuracy. Any mistakes should be corrected through the local sales representative. When the actual delivery date is known, EPA should coordinate with the building manager, elevator operators and receiving area to notify them of the anticipated arrival and to plan the pathway for the equipment to be moved from the receiving area to the machine room. The machine room should be clear of extraneous furniture. The people who work in the machine room should be warned about the forthcoming disruption, as well. When the delivery is made, the truckers will bring all the equipment either to the dock or into the machine room (or temporary storage area), depending on building and union rules. In addition to the hardware cabinets, the delivery will include several large crates of documentation and miscellaneous equipment. The space required for delivering and unpacking the crates is approximately twice that of the installed equipment.

There are several special arrangements that can be made if the doorways clearances are too small. All crates come on skids that add about eight inches to the height of the crates. For the large cabinets (72" without the skids) and low ceilings or elevators, EPA may have to request that the skids be removed in the DIGITAL warehouse prior to delivery, because the truckers are not allowed to remove the skids or unpack the crates on site. For narrow passages, the large cabinets can be specified as single units rather than double units to avoid an extremely circuitous or otherwise impossible route to the machine room. Specification of single cabinets, however, should have been made at the time of the order.

When the truckers arrive, an EPA staff person should be available to receive them, show them the route to the machine room and show them where to put the equipment crates. EPA can help reduce the installation effort by requesting that the truckers place the equipment close to where it will be sited permanently. Also there is one box that contains a bright colored sticker that reads "READ ME FIRST". The truckers should be requested to place that box where it can be accessed conveniently. It contains the installers manuals DIGITAL's Field Service Engineers will want to open first.

After the equipment has been delivered, the system manager should perform a check to see if the Notification of Shipment agrees with what actually arrived. There are packing slips on most of the crates and labels inside the large cabinets on the system unit boxes. The system manager should be able to identify all major items and complete the check within an hour. Do not unpack the crates or remove the skids. Call DIGITAL Field Service to schedule installation and perform the unpacking.

2. <u>EPA MUST NOTIFY DIGITAL WHEN ALL THE EQUIPMENT HAS BEEN DELIVERED IN ORDER TO SCHEDULE INFORMATION</u>.

DIGITAL Field Service does not know the exact date of delivery and therefore must be notified when the equipment has arrived. DIGITAL will then schedule their Field Service Engineers to come and install the equipment. The installation should take place within one or two days of the notification. This effort includes all phases from unpacking the received shipping crates, through set-up to satisfactory installation and integration of the equipment. The Field Service Engineers will need several days at EPA to perform the installation.

The EPA Project System Manager should be available to the Field Service Engineers during installation. The Field Service crew will need to see the floor layout place to know where to set-up the equipment. They will bring all their own tools, but may need common office supplies and need to have questions answered by EPA.

Once the equipment has been installed physically, mechanically and electrically, the Field Service Engineers will turn the power on and run diagnostics to confirm that each device is in working order. However, the System Manager should request the Field Service Engineers to run the diagnostics on all the units of multiunit devices. Installation continues until all equipment successfully completes DIGITAL's diagnostic tests and meets DIGITAL's performance standards. The Field Service Engineers certify that the system is "ready for use", that is, ready for acceptance testing. The System Manager should continue to run diagnostics to identify hardware problems, if any. Field Service should be notified of any problems immediately. If the system is not ready for acceptance testing within 180 days of the order because DIGITAL did not install all ordered equipment, accessories, special features and basic operating aids, then DIGITAL must pay EPA liquidated damage fees. See ARTICLE XXV in the contract between EPA and DIGITAL for the specific terms of delayed installation.

After installation of each equipment unit, DIGITAL will issue a letter to the EPA Project Officer. This letter will identify the date and location of installation, and the model and serial numbers of all units installed. DIGITAL will provide two copies of available manuals for each equipment unit. Also, these manuals describe the operating procedures, technical aspects and maintenance requirements of the equipment and related software.

Software Support at DIGITAL must be notified when installation of the equipment has been completed so that the software can be installed. If Software Support knows when hardware installation is taking place, they can schedule software installation immediately following hardware installation. For a timely software installation EPA should take four steps, as follows:

- Acquire the name of the Support Software person from the sales representative, prior to hardware installation
- Make sure that the Support Software person has had experience in the installation of the operating system and emulator(s) ordered

- Contact the Software Support person and the sales representative to set a tentative date for software installation

- Confirm the software installation date when the hardware has been certified as ready for use and when the multi function diagnostic has been running without errors for at least 48 hours, continuously

EPA should follow these four steps so that the software can be installed promptly and the machine made productive as soon as possible.

Software installation includes a "sysgen", which adds patches and new releases to the basic software package, and parameterizes the software to meet the specific needs of each installation. The initial sysgen often takes one or two days in itself, whereas subsequent adjustments can be made quickly. CSSD is available for consulting on initial sysgens. While Support Software is performing the "sysgen", they should work closely with the System Manager. Once the "sysgen" has taken place, the EPA installation is ready to begin acceptance testing.

3. <u>EPA UNDERGOES ACCEPTANCE TESTING UNTIL THE SYSTEM RUNS AT AN AVERAGE EFFECTIVENESS OF 90% FOR THIRTY CONSECUTIVE DAYS</u>.

The Acceptance Test is a formal period of testing the installed hardware and software. This test requires that the system run for thirty consecutive days with 10% or less downtime. This thirty day period of 90% effectiveness is called the "Successful Performance Period". Once concluded, payment for the system is due retroactively to the first day of the Successful Performance Period. ARTICLES XXIV and XXX in the contract between DIGITAL and EPA contain the standard of performance and acceptance terms.

(1) <u>The Data Center Should Test the PDP 11 Twenty-four Hours a Day During Acceptance Testing</u>.

The PDP 11 system should be exercised continuously during the acceptance test period. Prior to installation, programs should be available for use as exersizers. DIGITAL provides hardware diagnostics and multiprogramming testers that should be used in the evenings and during spare time. Check with CSSD, and other

installations for additional test programs. During working hours, normal operations, such as batch processing, text editing, utilities and RJE operations should be tested also. During the evenings the program exersizers should be loaded and left running. The program DEM52, which was written at CSSD, shows computer utilization. This program should be run during acceptance testing to check for possible bottlenecks. Problems that arise should be reported to both DIGITAL and CSSD, where a central trouble report file is being maintained.

(2) EPA Is Required to Keep Accurate Records of the PDP 11's Performance During Acceptance Testing.

The contract between DIGITAL and EPA requires that the Data Center keep daily records of the system's performance during the acceptance period. The acceptance period begins after both the hardware and software have been installed, and after a "sysgen" has been performed successfully. The acceptance period lasts for a minimum of thirty days. Each day the data center should record the system's productive time, downtime, and travel time involved in repairing the system. Productive time is the time the PDP 11 is operating. If no problems occur, this period should be 24 hours. Downtime is lost productive time. Downtime is calculated from the time EPA has contacted DIGITAL during working hours until the system or machine is restored to its proper operating condition. Travel time refers to DIGITAL's travel time when enroute to repair the system. Travel time is not to exceed two hours per call. At the end of thirty days, these daily records should be accumulated, and the effectiveness of the system determined. The system's effectiveness level is calculated using the following formula:

$$\text{Effectiveness Level} = \frac{P}{P + D - T} * 100\%$$

where:

P = Total productive time over the last 30 days
D = Total downtime over the last 30 days
T = Total travel time over the last 30 days

If after the first 30 days, the effectiveness level is less than 90%, then the acceptance period is extended one day at a

time. Each day the effectiveness level is recalculated. This process continues until the effectiveness level reaches 90% or better. Once reached, the "Successful Performance Period" is defined as the last 30 days. EPA then must notify DIGITAL in writing of the first day of the Successful Performance Period.

(3) Payment for the System Becomes Due and the 90-Day Warranty Period Begins Retroactively to the First Day of the Successful Performance Period.

Lease and maintenance charges for leased equipment begin on the first day of the Successful Performance Period, as retroactively determined. For purchased equipment, the 90-day warranty period starts on that day. If leased equipment is purchased during the 90-day period following the first day of the Successful Performance Period, then the warranty applies for the remainder of the 90-day period. For the specific contract terms of payment and warranty see ARTICLE XVI and ARTICLE XIX, respectively.

For basic monthly charges, DIGITAL renders invoices in the month for which the charges accrue. These invoices are payable when billed. The invoice includes four items, as follows:

- Type and description of equipment
- Serial number
- Basic monthly charges for each machine
- Total charges

For purchased items or any subsequent modifications, invoices are submitted only after inspection by the Project Officer or designated representative and after final acceptance by the Contracting Officer. The invoices for purchased equipment contain five items, as follows:

- Contract number
- Order number
- Description of services
- Unit prices
- Extended totals

'll invoices are submitted to MIDSD, then forwarded to the ›ntracting Officer.

APPENDIX A -- IMPLEMENTATION PLAN CHECKLIST BY PHASE

CONVERSION DESIGN PHASE

Assumptions:

- Vendor supplies test machine
- Vendor supplies manuals and documentation
- Vendor supplies training
- Vendor supplies assistance in site preparation
- Contract Management Division processes order expeditiously

Work Products Completed:

- Hardware configuration finalized
- Training plan
- Site preparation plan
- Conversion design specification
- Conversion specification
- Programming standards

Major Activities:

- Plan
- Finalize configuration and place order
- Produce training plan
- Produce site preparation plan
- Establish priorities for converting applications to minicomputers
- Evaluate differences between DIGITAL languages and current languages, and produce conversion guidelines and standards
- Find another machine to be used for development and test, and make appropriate arrangements for use and payment of use
- Analyze and specify conversion process that must take place
- Develop formal development policies and procedures
- Review

Resource Requirements:

- Analysts
- Project Officer
- Management support

HARDWARE INSTALLATION PHASE

Assumptions:

- Vendor installation
- Vendor software support
- Vendor training
- Deinstallation of replaced equipment
- CSSD supplies test programs

Work Products Completed:

- Site prepared
- Minicomputer hardware and software installed
- Acceptance of minicomputers

Major Activities:

- Plan
- Prepare site
- Relocate replaced equipment
- System Manager training
- Receive new equipment
- Notify DIGITAL Field Service to install equipment
- Install operating system
- Commence acceptance test
- Conduct on-site training
- Operate machine and log performance
- Accept after successful Performance Period
- Remove replaced equipment
- Train rest of organization
- Train operations
- Review

Resources Required:

- System Manager
- Instructors for training
- Operations staff
- Analyst and programmers
- External contractors for site preparation

PROGRAMMING PHASE

Assumptions:

- Computer time available for teaching
- Training by DIGITAL will be completed by MM/DD/YY

Work Products Completed:

- Development procedure standards
- Program change specification
- Programs and program change documentation
- Unit test plan
- Integration test plan
- Test report standard

Major Activities:

- Plan
- Establish development procedures
- Code changes
- Unit test on all modules
- Prepare integration test specifications
- Review

Resources Required:

- Analysts
- Programmers

ACCEPTANCE TEST PHASE

Assumptions:

(No additional assumptions)

Work Products Completed:

Acceptance criteria or agreement

Major Activities:

- Conduct acceptance test
- Obtain sign-off on acceptance test
- Complete training of users and operations

Resources Required:

- Project Officer
- MIDSD representative
- System Manager
- Analyst

CONVERSION PHASE

Assumptions:

- Support from previous installation for trouble shooting
- Availability of finely tuned utilities from CSSD
- Backup capability

Work Products Completed:

- Documentation
- Operations standards and controls
- Training

Major Activities:

- Plan
- Convert data base
- Institute normal operations controls
- Perform parallel or pilot runs
- Monitor test results closely
- Project cost savings

Resources Required:

- System Manager
- Analyst
- Support programmers
- Operations

OPERATIONS AND MAINTENANCE PHASE

Assumptions:

(No additional assumptions)

Work Products Completed:

- Change control standards
- Trouble reporting standards

Major Activities:

- Operate systems
- Log operations
- Schedule jobs
- Track hourly load
- Evaluate system usage and use to assess needs for more disk, memory, terminals, printers or tapes
- Identify problems
- Conduct reviews periodically
- Set up maintenance team

Resources Required:

- System Manager
- Operations
- Maintenance Programmer